

REMARKS

This application has been amended so as to place it in condition for allowance at the time of the next Official Action.

The Official Action objects to the abstract for being too lengthy. Applicants include herewith a substitute abstract that meets the requirement of U.S. practice. Reconsideration and withdrawal of this objection are therefore respectfully requested.

The Official Action objects to the disclosure because of an identified typographic error in the narrative portion of the specification. Applicants have amended the specification as necessary in order to eliminate the basis for this objection, the reconsideration and withdrawal of which are therefore respectfully requested.

The Official Action rejects claim 18 under 35 USC §112, second paragraph, as being indefinite. Underlying this rejection is the recitation in claim 18 of "said physical and chemical etching". Applicants have amended claim 18 to depend from claim 17, which introduces the physical and chemical etching feature. This eliminates the basis for this rejection, the reconsideration and withdrawal of which are therefore respectfully requested.

The Official Action rejects claims 1-6 and 11-16 under 35 USC §102(b) as being anticipated by GALLAGHER et al. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Official Action identifies those elements of the GALLAGHER et al. device interpreted as meeting the various recitations of independent apparatus claim 1 and independent method claim 12. The Official Action reads the recited substrate on element 9, and the recited lower portion structure as elements 12, 14, and 16 of GALLAGHER et al., collectively. These represent a seed layer, ferromagnetic layer, and anti-ferromagnetic layer. The recited upper portion structure is interpreted as reading upon element 30, which comprises layers 32 and 34, a free ferromagnetic and protective layer, respectively.

The final element of original claim 1 is a sidewall insulating film provided to surround the upper portion structure of the magnetic element. The Official Action reads this recited feature on element 40 of GALLAGHER et al. As described in the first full paragraph of the Description of the Preferred Embodiments in column 3 of GALLAGHER et al., and as similarly described in the remainder of such reference, element 40 is an insulating layer. As also described both in terms of structure and manufacturing method, a contact hole through the insulating layer 40 provides for contact between the wiring layer 50 and the upper portion structure 30.

Neither the specifically identified Figure 4A of GALLAGHER et al. nor any other drawing figure of such reference provides any indication of an outer limit or boundary of the insulating layer 40, considered from a plan view. Notably, each

drawing figure in GALLAGHER et al. provides a ragged leftmost and rightmost vertical edge for all of the layers other than the wiring layer 50. Accordingly, every indication offered by the GALLAGHER et al. reference is that the insulating layer 40 is essentially continuous, covering an entirety of the structure but for those apertures through which the wiring layer 50 passes.

Considering, for example, Figures 2D-2F of the present application, the physical portions of sidewall 19 are evident. Sidewall 19 is truly a wall structure, having a defined innermost and outermost surface. As illustrated in such drawings of the present application, as well as those representing other embodiments, the inner dimensions of sidewall 19 correspond to outer dimensions of the upper portion structure. In the embodiment illustrated in Figures 2D-2F, the upper portion structure comprises layers 15', 16', and 17'. Additionally, and as is most clear from present Figure 2E, there exists a further relationship between the outermost dimension of sidewall 19 and the lower portion structure, which includes layers 12', 13', and 14'. Specifically, the outermost dimension of the bottom of sidewall 19 matches the outermost dimension of the lower portion structure.

Accordingly, the sidewall 19 is not a layer that extends continuously across all of the various magnetic elements disposed upon the substrate. Rather, sidewall 19 is truly a

wall-shaped structure that surrounds the upper portion structure of a single device.

In accordance with these characteristics of the structure of the present device, applicants have amended claim 1 to recite additional features of the lower portion, upper portion, and sidewall. Specifically, each of the lower and upper portion structures includes a magnetic film. Moreover, and directly related to the physical characteristics of sidewall 19 described above in connection with Figures 2D-2F, the lower portion structure has an outer circumference that is the same as an outer circumference of a bottom of the sidewall insulating film. This corresponds directly to the illustrated dimensional relationships of the lower portion structure and sidewall insulating film illustrated most clearly in present Figure 2E. This feature is also referred to in original claim 2, now cancelled.

In reading the GALLAGHER et al. reference on claim 2, the Official Action states the conclusion that the GALLAGHER et al. device is illustrated in Figures 4A and 4B thereof exhibits the feature that the magnetic element has the size of an outer circumference of the sidewall insulating film. As the Official Action interprets element 40 as the sidewall insulating film, it is unclear to applicants how the identified drawings from the GALLAGHER et al. and/or any other disclosure thereof provides an indication of an outer circumference of element 40. As to

elements 11 and 13 illustrated in Figure 4B of GALLAGHER et al., the paragraph spanning columns 3 and 4 of GALLAGHER et al. makes clear that these are extensions of the base electrode 10. Element 50 represents the contact illustrated in profile in Figure 4A. However, neither of these elements provides any indication of any outer circumference of element 40, as wiring layer 50 lies above layer 40 except where it penetrates layer 40 to make contact with the upper stack 30. The extensions 11 and 13 of the lower stack 10 lie entirely beneath element 40.

Accordingly, applicants respectfully suggest that the GALLAGHER et al. reference fails to disclose the full set of features now recited in amended independent apparatus claim 1.

Applicants have amended claim 3 as to matters of form.

Applicants have amended claim 4 into independent form by incorporating the features of original claim 1. Claim 4 also recites the characteristics of the sidewall insulating film and the relationship of the outer circumference of the lower portion structure and the outer circumference of the bottom of the sidewall insulating film. Claim 4 in independent form differs from claim 1 in that the upper portion structure is recited as comprising both the first and second magnetic films, with the insulating film lying therebetween. This can be seen clearly, for example, in present Figure 3E.

Accordingly, each of claims 1, 3-6 and 11, either by literal recitation or by virtue of dependency, incorporates the

set of features that is clearly absent from the GALLAGHER et al. reference.

Rejected claims 12-16 recite a method of manufacturing a magnetic memory. Considering independent method claim 12, the Official Action identifies the passages of text in the GALLAGHER et al. reference interpreted as meeting the various recited claim steps.

The Official Action makes specific reference to text in columns 9 and 10 of GALLAGHER et al. The Official Action reads the first three recited steps, respectively, on the text in column 9, lines 34-36, column 10, lines 1-14, and column 10, 31-33. Appropriately, these three sequentially performed steps as recited in claim 12 are read on three consecutively performed steps as described by the GALLAGHER et al. reference.

The fourth recited step of independent method claim 12 makes particular reference to features introduced by the previously recited method steps, namely, the multi-layer film of the first method step, the upper portion structure of the second method step, and the sidewall insulating film of the third method step. Accordingly, the final recited method step of etching a remaining portion of the multi-layer film by using the sidewall insulating film in the upper portion structure of a magnetic element as a mask to form a lower portion structure of a magnetic element necessarily can be performed only after forming the multi-layer film, forming the upper portion structure, and

forming the sidewall insulating film. The sequence of steps identified in the GALLAGHER et al. reference therefore cannot reasonably be interpreted as meeting the recited features, at least for the reason that the GALLAGHER et al. steps are taken out of order.

Considering the identified steps of the GALLAGHER et al. reference in detail, the steps interpreted as forming a multi-layer film and etching the multi-layer film might be interpreted as reading on the identified passages in the GALLAGHER et al. reference. However, the recited step of forming a sidewall insulating film is read on the GALLAGHER et al. step of forming a conformal insulating layer 60 over the entire patterned junction structure, as illustrated in Figure 8F of such reference. The final recited step of etching a remaining portion of a multi-layer film by using the sidewall insulating film, among other elements, as a mask is read on the GALLAGHER et al. step of applying a second resist pattern 90 on the wafer to allow for argon ion milling removal of selected regions of the tunnel barrier 20 and base electrode stack 10, which are not protected by resist. In the GALLAGHER et al. process, this step is clearly performed prior to that of creating the conformal layer 60. Accordingly, the GALLAGHER et al. method cannot reasonably be interpreted as using an element in a given step which is not created until a subsequent step.

Accordingly, independent method claim 12 is unchanged by the present amendment, and reconsideration and withdrawal of the rejection applied against such claim are respectfully requested.

The remaining claims 13-16 addressed by the present rejection each ultimately depends from independent claim 12. Accordingly, at least by virtue of the implicit recitations of the features of claim 12, each of these claims is believed to be unanticipated by the GALLAGHER et al. reference.

The Official Action rejects claims 1, 8, 9, and 11 under 35 USC §102(b) as being anticipated by TUTTLE et al. The analysis provided above in connection with the anticipation relying on GALLAGHER et al. applies similarly to the present rejection. The Official Action offers element 26 as the sidewall insulating film provided to surround the upper portion of the magnetic element. As with the layer 40 of GALLAGHER et al., layer 26 of TUTTLE is a continuous layer that extends across an entirety of the substrate. Accordingly, it lacks the circumference dimensions and the correspondence between circumference and that of related elements now recited in independent claim 1. As each of claims 8, 9, and 11 ultimately depends from amended independent claim 1, these claims implicitly recite such features. For these reasons, reconsideration and withdrawal of this rejection are respectfully requested.

The Official Action rejects claim 7 under 35 USC §103(a) as being unpatentable over GALLAGHER et al. in view of BHATTACHARYYA et al. The secondary BHATTACHARYYA et al. reference is offered merely for its asserted teaching or suggestion of the recited dimensional relationship of Figure 7. However, irrespective of the ability of this reference to teach or suggest that for which it is specifically offered, it nevertheless fails to overcome the shortcomings of the primary GALLAGHER et al. reference as to the features of amended independent claim 1, recited implicitly in claim 7. For at least this reason, reconsideration and withdrawal of this rejection are respectfully requested.

The Official Action rejects claim 10 under 35 USC §103(a) as being unpatentable over GALLAGHER et al. in view of DURLAM et al. The secondary DURLAM et al. reference is offered for its asserted teaching or suggestion of materials from which a sidewall insulating film might be formed. However, the element 40 of DURLAM et al. to which the identified text refers cannot be interpreted as a sidewall insulating film, particularly as that term is used in amended independent claim 1. For at least this reason, reconsideration and withdrawal of this rejection are respectfully requested.

The Official Action rejects claims 17 and 18 under 35 USC §103(a) as being unpatentable over GALLAGHER et al. in view of YOSHIDA et al. The secondary YOSHIDA et al. reference is

offered merely for its asserted teaching or suggestion of the etching of a multi-layer film using reactive ion etching, which is both a physical and a chemical etching method. However, irrespective of the ability of this reference to teach or suggest that for which it is specifically offered, it nevertheless fails to overcome the shortcomings of independent method claim 12, from which each of these claims ultimately depends, and reconsideration and withdrawal of this rejection are respectfully requested.

The Official Action rejects claims 19 and 20 under 35 USC §103(a) as being unpatentable over GALLAGHER et al. in view of OKAZAWA et al. The OKAZAWA et al. reference is a published European patent application. Before considering this reference as to its merits, applicants will first address the threshold question of whether the OKAZAWA published application is prior art.

The OKAZAWA EP application has a publication date of October 9, 2002. That publication date is less than one year prior to the effective U.S. filing date of September 19, 2003 for the present application. Accordingly, the EP publication is not 35 USC §102(b) prior art.

The OKAZAWA EP published application makes a priority claim to a Japanese application filed April 6, 2001. If such Japanese application were published exactly 18 months from its filing date, it would have a publication date of October 6, 2002.

This date also falls after the present application's priority date, and is less than one year prior to the present application's effective U.S. filing date. Accordingly, such potential publication of the OKAZAWA priority document, like the applied EP reference itself, fails to constitute prior art under either 35 USC §102(a) or §102(b).

Applicants have determined that there exists a U.S. equivalent to the cited OKAZAWA EP reference. Such corresponding U.S. application issued September 6, 2005 as U.S. Patent 6,939,722. Such date of issuance does not render the U.S. equivalent as prior art under either 35 USC §102(a) or §102(b). The U.S. OKAZAWA et al. application published October 10, 2002. This publication date also falls after the priority date of the present application and is less than one year prior to the U.S. filing date of the present application, and thus the OKAZAWA U.S. publication is not prior art under 35 USC §102(a) or §102(b).

The OKAZAWA et al. U.S. patent, however, has a U.S. filing date of April 4, 2002. While applicants reserve the right to prove need of invention prior to this April 4, 2002 filing date, such date falls prior to the priority date of the present application. While subject to being overcome by proof of prior invention, the OKAZAWA et al. U.S. reference is prior art under 35 USC §102(e), and Applicants include with the present amendment an Information Disclosure Statement that formally makes the U.S. OKAZAWA et al. patent of record.

However, even considering OKAZAWA et al. as to its merits the combination of references fails to render obvious the rejected claims, for at least the following reasons.

The sidewall of the present invention is formed after the upper electrode is processed. Such sidewall is formed by forming an insulating film of SiN or similar material and then carrying out etching. In stark contrast, in the OKAZAWA et al. reference the sidewall is a re-deposition substance attached during the process of forming the upper electrode. Necessarily, the re-deposition substance is composed of a magnetic metal substance as the material of the upper electrode and tunnel barrier film.

Moreover, in the present invention, the lower electrode is processed by using the side wall as a mask. In the OKAZAWA et al. reference, the lower electrode is etched again by using a resist pattern.

As the only rejection against claims 19 and 20 is thereby overcome, these claims are believed to be in condition for allowance.

The present filing requests reconsideration and withdrawal of the rejection of a number of claims that applicants have not amended. Accordingly, if the next Official Action includes new grounds for rejection of any such unamended claims based on prior art that is not already of record, applicants note

that such subsequent Official Action cannot be made final under USPTO practice.

In light of the amendments provided above and the arguments offered in support thereof, applicants believe that the present application is in condition for allowance and an early indication of the same is respectfully requested.

If the Examiner has any questions or requires further clarification of any of the above points, the Examiner may contact the undersigned attorney so that this application may continue to be expeditiously advanced.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

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Appendix:

The Appendix includes the following items:

- substitute abstract
- Information Disclosure Statement